BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division INDUSTRIAL HYGIENE GROUP Standard Operating Procedure: Field Procedure	NUMBER **IH99110** REVISION **FINAL rev 1**
SUBJECT: GENERAL PRINCIPLES: **Static Magnetic Field Measurement Principles: Area Surveys**	DATE **03/29/05** PAGE **1** OF 22

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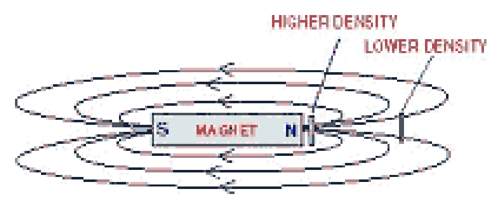

1.0 <u>Purpose/Scope</u>

This procedure provides a standardized method for conducting area surveys with direct reading meters. It should be used in conjunction with the SBMS Subject Area Static Magnetic Fields (SMF) and an *Instrument Operation* procedure in the series as IH SOP IH99240 Instrument Operation: F.W. Bell Gauss Meter, IH99380 and IH99400 THM 7025 3-Axis Hall Magnetometer.

An area survey meter should be used to determine baseline static magnetic field area levels and the need for further dosimetry. Survey meters are designed for conducting static magnetic field surveys to determine the need for area warning posting, locate problem-static magnetic field sources, and measuring the effectiveness of engineering controls. It can be used as a screening tool to determine the need for personal monitoring and to sketch isometric lines for control area delineation.

Generally, employee exposure assessments should be made with a static magnetic field dosimeter when the levels indicate that the exposure will exceed exposure guidelines. However an area survey meter can be used as a screening tool to identify those areas that may need further employee assessment or for operations that are of short duration (15 to 30 minutes) and that involve limited employee movement so that the meter can measure the actual employee exposure. In these cases, the meter reading must be observed and recorded over the entire time of exposure. It can also be used to map the area so as to determine posting levels and zones that may require additional precautions (e.g., special tool handling; limitation of personnel; training; barriers, etc).

2.0 Responsibilities

2.1 **Program Administration:** This procedure is administered through the SHSD Industrial Hygiene Group.

2.2 Members of the SHSD Industrial Hygiene Group are required to follow this procedure.

2.3 Other BNL organizations that provide BNL with field monitoring or other hazard assessment services are required to follow this SOP or an equivalent document that ensures an equal or superior method of assessment documentation and recordkeeping.

2.4 ***Industrial Hygiene Professional:*** The *Industrial Hygiene Professional* of SHSD and other BNL organizations are to be qualified by their supervision. These individuals will conduct or supervise industrial hygiene hazard assessments and personal exposure monitoring using this procedure. These *IH Professionals* are responsible for:

- Interpreting, reporting, and documenting personal exposure monitoring in accordance with the requirements of this procedure, other appropriate SOPs, and generally accepted professional standards and practices.
- Ensuring a quality report is prepared that documents the exposure, evaluates the relevance to exposure standards, and recommends protective and corrective actions.
- Ensuring the final report is provided in a timely manner to all appropriate parties.
- Ensuring that the appropriate data is correctly and completely entered into the BNL IH exposure monitoring database (i.e. *Compliance Suite*®).
- Ensuring that original records of sampling and analysis enter the SHSD *Record Custodian* filing system.

2.5 ***Industrial Hygiene Technician (Sampler)*:** The industrial hygiene technician is to be qualified by their supervision to conduct industrial hygiene personal exposure monitoring under the direction of his/her organization's *IH Professional.* The sampler is responsible for collecting personal exposure monitoring samples in accordance with the guidance of the *IH Professional* and the requirements of all

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SOP's pertinent to the particular monitoring requirements (i.e. Chain of custody, equipment check in/out, equipment operation, recordkeeping, etc.).

2.6 ***Compliance Suite*® *data entry:*** The management of the person conducting the sampling is responsible for entering complete and correct data into the BNL IH exposure monitoring database (i.e. *Compliance Suite*). This task may be assigned to one or more individuals who act as the data entry person for an organization, however, it remains the responsibility of the line management of the *Sampler* to ensure this task is fulfilled within 21 calendar days of the end of the sampling event.

3.0 Definitions

3.1 *Gauss* (G) – in the CGS system, this the unit for one flux line passing through one square centimeter.

3.2 *Magnetic Field* – for static magnetic fields and extremely low frequencies, this is generally used for the magnetic flux density. When referring to RF and microwaves, the term usually means magnetic field strength (H field).

Table 1. Static Magnetic Field Units

INTEGRATED SYSTEM (SI UNITS)		**CENTIMETER-GRAM-SECOND UNIT SYSTEM (CGS)**	
Tesla (T)	**MilliTesla (mT)**	**Gauss (G)**	**Milligauss (mG)**
1	1000	10,000	10,000,000
0.1	100	1000	1,000,000
0.01	10	100	100,000
0.001	1	10	10,000
0.0001	0.1	1	1000

3.3 *Magnetic field strength* –(H) vector field () with units of amps per meter.

3.4 *Magnetic Flux Density (B) Gauss:* The number of magnetic flux lines per area that is induced by an applied magnetic field intensity H. The B results from an applied H is given by B = μH, where μ is the permeability (sometimes referred to as the *absolute permeability)* of the magnetic material in which the flux is contained. Where U is zero then B=H.

3.5 *Magnetic Field Strength or magnetizing force (H)* - The force within the magnet that produces the flux lines.
It must be understood that flux density and magnetic field strength are related but not equal. The intrinsic characteristics of the magnetic material must be considered. Only in free space (air) are flux density and field strength considered equal.

3.6 *Occupational Exposure Limit:* The maximum time weighted average (TWA) or ceiling value exposure permitted for employee exposure, based on the less of the OSHA Permissible Exposure Limits (PEL) or ACGIH Threshold Limit Value (TLV). OSHA does not have a static magnetic field standard. BNL has adopted the following found in the Static Magnetic Field subject area.

BNL Exposure Limits for Static Magnetic Fields		
Areas of Concern	***8-hour Time-Weighted Average (TWA)***	***Ceiling***
Medical Electronic Device Wearers *(e.g., cardiac pacemakers, electronic inner ear prostheses, insulin pumps)*	--	.5 mT (5 G)
Ferromagnetic Objects *(includes tools and medical implants/prostheses)*	--	60 mT (600 G)*****
Whole Body	60 mT (600 G)	2 T (20,000 G)
Limbs	600 mT (6,000 G)	5 T (50,000 G)

*****The ferromagnetic magnetic objects ceiling limit is based on Fermi Laboratory guidance. See the Magnetic Forces on Ferromagnetic Objects exhibit for more information.

Note: Exposure levels as low as 1 mT (10 Gauss) have been reported to cause deletion of information on magnetic memory materials, such as found on credit cards, identification badges, computer disks, and video tapes.

3.7 *Tesla* (T)- In the SI system this is 10,000 lines per square centimeter. Unit of magnetic induction or magnetic flux density (B field) in the meter-kilogram-second system (SI) of physical units. One Tesla equals one weber per square meter (or magnetic flux per unit area), corresponding to 10^4 gauss

4.0 Prerequisites

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4.1 **Training prior to using this ozone generator:**

4.1.1 Demonstration of proper operation of the procedure to the satisfaction of the line supervision or the appropriate SHSD IH Program Administrator. See Section 7 for qualification requirements.

4.1.2 Other appropriate training for the area to be entered (check with ESH coordinator or FS Representative for the facility).

4.2 **Area Access**:

4.2.1 Contact the appropriate Facility Support Representative or Technician to obtain approval to enter radiological areas.

4.2.2 Verify with the appropriate Facility Support Representative or Technician if a Work Permit or Radiological Work Permit is needed or is in effect. If so, review and sign the permit.

4.2.3 Use appropriate PPE for area.

5.0 Precautions

5.1 Hazard Determination:

5.1.1 The operation of an area survey meter or use of this procedure does not cause exposure to any chemical, physical, or radiological hazards. The meters do not generate Hazardous Waste.

5.1.2 The operation an area survey meter or use of this procedure does not cause exposure to any chemical, physical, or radiological hazards, or generate Hazardous Waste.

5.1.2.1 By its very nature, a SMF survey meter may be used in areas where excessive SMF levels exist or are suspected to be present. Check the instrument procedures to determine if there are limitations on the strength of field that the instrument can be introduced. The user must take into consideration the effects of such strong magnetic fields.

5.1.2.2 If individuals using a meter wear pacemakers, or other medical electronic devices, they may not be exposed to fields greater than or equal to 0.5 mT (5 Gauss) without consultation with the Occupational Medicine Clinic. Also, individuals with ferromagnetic implants should not be exposed to levels greater than or equal to 60 mT (600 G) without clearance from the Occupational Medicine Clinic.

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5.1.3 In areas where the field strength may potentially exceed 10 mT (100G), exposure levels as low as 1 mT (10 Gauss) have been reported to cause deletion of information on magnetic memory materials, such as found on credit cards, identification badges, computer disks, and video tapes. Watches may be stopped.

5.2 Personal Protective Equipment:

5.2.1 Use nonmagnetic objects or tools when working with or around magnetic fields above 60 mT. These objects may be drawn into the magnet and pose a flying object hazard. Metal-toed safety shoes may also be affected.

5.2.2 Additional PPE: Other appropriate PPE for hands, feet, skin, head, or eyes may be needed for the area being entered because of other hazards. Check with your ES&H representative.

5.3 **Job Risk Assessment:** Consult the *Job Risk Assessment* below for the hazards and controls of this SOP.

	1	2	3	4	5
Frequency	≤once/year	≤once/month	≤once/week	≤once/shift	>once/shift
Severity	First Aid Only	Medical Treatment	Lost Time	Partial Disability	Death or Permanent Disability
Likelihood	Very Unlikely	Unlikely	Possible	Probable	Multiple

Activity	Hazard	Control(s)	Before Additional Controls						Control(s) Added to Reduce Risk	After Additional Controls						
			Stressor	# of People A	Frequency B	Severity C	Likelihood D	Risk* AxBxCxD		Stressors	# of People A	Frequency B	Severity C	Likelihood D	Risk* AxBxCxD	% Risk Reduction
Taking SMF measurements with direct reading meters	Exposure to SMF E and B fields	Observation of meter reading and maintaining appropriate distance from hazardous levels.	N	1	2	1	3	6								
	Exposure to other hazards such as chemicals and ionizing radiation	Follow Work Control Procedures and Radiological Work Permits in the area	N	1	2	2	2	8								

6.0 <u>Procedure</u>

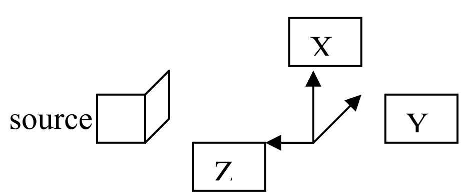
6.1 **Select the appropriate piece of equipment.**
6.1.1 Determine if the field strength is within the range of the equipment.
6.1.2 Operate the meter as per the BNL Instrument Operation SOP.

6.2 **Calibrate** the meter as per the Instrument Operation SOP. Perform this in a low background area. BNL requires daily calibration to a portable calibrator. Check if the instrument reads zero. Indicate this on the sheet. If the instrument does not read zero, then the probe must be placed in the zero field chamber. This must be done in an area without a magnetic field. Record results on survey sheet.

6.3 **Take measurements**
6.3.1 Approach source, taking reading from further away.

6.3.2 For meters that provide the route-mean-square (rms) value of all the fields at that position (triaxial response), skip to step 6.4.

6.3.3 For meters that do <u>not</u> provide integrated rms readings, the users must take the rms values of the three orthogonal measurements (Bx, By and Bz).
6.3.3.1 For a transverse probe, the flat surface is rotated through the axis,



Bx = perpendicular to the source
By = parallel to the source
Bz = vertical to the source, or

6.3.3.2 The user should peak the probe, a process in which the probe is rotated and tilted in several planes to obtain the highest possible output for a given field. At each axis (x,y,z), rotate the probe till you find the highest value. Without changing the base location, then rotate the probe to the next axis and find the highest value again. Do this for each axis and take the highest reading.

6.3.4 Take measurements at the following locations

6.3.4.1 Take at least 5 measurements along the vertical plane from floor to about 6.5 feet high. Measurements should be at a max of 20 cm (~8 inches) apart. Determining point of highest concentration. Note the position.

6.3.4.2 Take at least 4 additional measurements at equal distance away from the centerline. Repeat along all surfaces of source.

- 5 mT line/perimeter
- 10 mT
- 60 mT line/perimeter
- Maximum whole body exposure
- Maximum extremity Exposure
- Reading at source if not exceeding meter capacity.
- The purpose is to identify potential exposures and hazards from flying objects.
- Determine what typical operating positions are and where maximum exposures are possible. If personnel are never in close proximity to the instrument, then it is not necessary to measure surface levels. Document findings.
- If fields are about 60 mT also take a stick with some paperclips to visually identify gradients and to make sure that surrounding structures and equipment are not affecting the fields.

6.4 **Calculations**

6.4.1 For meters that do <u>not</u> provide integrated RMS readings (such as the Bell Gauss meter), calculate the static magnitude by taking the resultant of the x, y, and z components (square root of the sum of $x^2 + y^2 + z^2$).

6.4.2 For all instruments, spatially average the values across the vertical range or visually identify the highest value as the worst-case incident.

6.5 **Recording readings:**

6.5.1 Use a BNL Static Magnetic Fields Forms (found in SBMS subject area) to record readings and additional required information.

6.5.2 Return meter and original sampling form to the SHSD IH Laboratory. Copy goes to the ESH Coordinator.

6.5.3 If levels are greater than 0.5 mT (5 Gauss) and employees with medical electronic devices are exposed, send a copy to the Occupational Medicine Clinic.

6.5.4 Plan and conduct hazard assessments and exposure monitoring using the procedure outlined in I*H 60500 Reporting Personnel Exposure Monitoring Results* for:

- Exposure Assessment Sampling Strategy,
- Initial Notification of Employee Monitoring Results, and
- Preparation of a formal report on the exposure monitoring or hazard assessment.

6.5.5 Ensure that a copy of any hazard evaluation report written by a competent person on the survey is sent to the IH Laboratory and the Occupational Medicine Clinic, the department ESH coordinator, and the individuals surveyed.

7.0 Implementation and Training

Prior to using this procedure, the user:

7.1 Demonstrates proper operation of this instrument to the satisfaction of line supervision or SHSD IH Program Administrator.

7.2 Completes other appropriate training for the area to be entered (check with ESH coordinator or FS representative for the facility).

7.3 Completes OT&Q Training and a medical surveillance required for any PPE used on the job or for other hazards encountered in the work area.

7.4 Completes qualification on this procedure on at least a 3 year basis, providing the professional uses the equipment several times per year.

7.5 Personnel are to document their training using the Qualification Criteria listed in *IH51800 Industrial Hygiene Service Delivery Basic Qualification Requirements.*

8.0 References

8.1 SBMS subject area *Static Magnetic Fields*

8.2 NIOSH. Manual for Measuring Occupational Electric and Magnetic Field Exposures. Bowman, J.D.*; Kelsh,** M.A.; Kaune, W.T.*** National Institute for Occupational Safety and Health.* EcoAnalysis, Inc., Ojai, CA**; EM Factors, Inc., Richland WA***. US Department of Heath and Human Services, Public Health Service, Centers for Disease Control and Prevention, National

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Institute for Occupational Safety and Health, Division of Biomedical and Behavioral Services, October, 1998.

8.3 ACGIH American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (most recent).

9.0 Attachments

9.1 Flowchart of Magnetic Field Measurements
9.2 Theory of Magnetic Field Measurements
9.3 Field Survey Forms

10.0 Documentation

Document Review Tracking Sheet		
PREPARED BY: *(Signature and date on file)* **N. M. Bernholc** **Author** **Date 07/02/01**	**REVIEWED BY:** *(Signature and date on file)* **J. Peters** **SHSD IH Group** **Date 07/02/01**	**APPROVED BY:** *(Signature and date on file)* **R. Selvey** **SHSD IH Group Leader** **Date 07/05/01**
Filing Code: **IH51QR.01**	**DQAR** **Date**	**Effective Date:** **07/06/01**

Periodic Review Record		
Date of Review	Reviewer Signature and Date	Comments Attached
03/29/05	*(Signature and date on file)* R. Selvey 03/29/05	Revised to include Section 7 Implementation and Training. Text added to Section 2, 4,5, 6, and 7. JRA added to Section 5.

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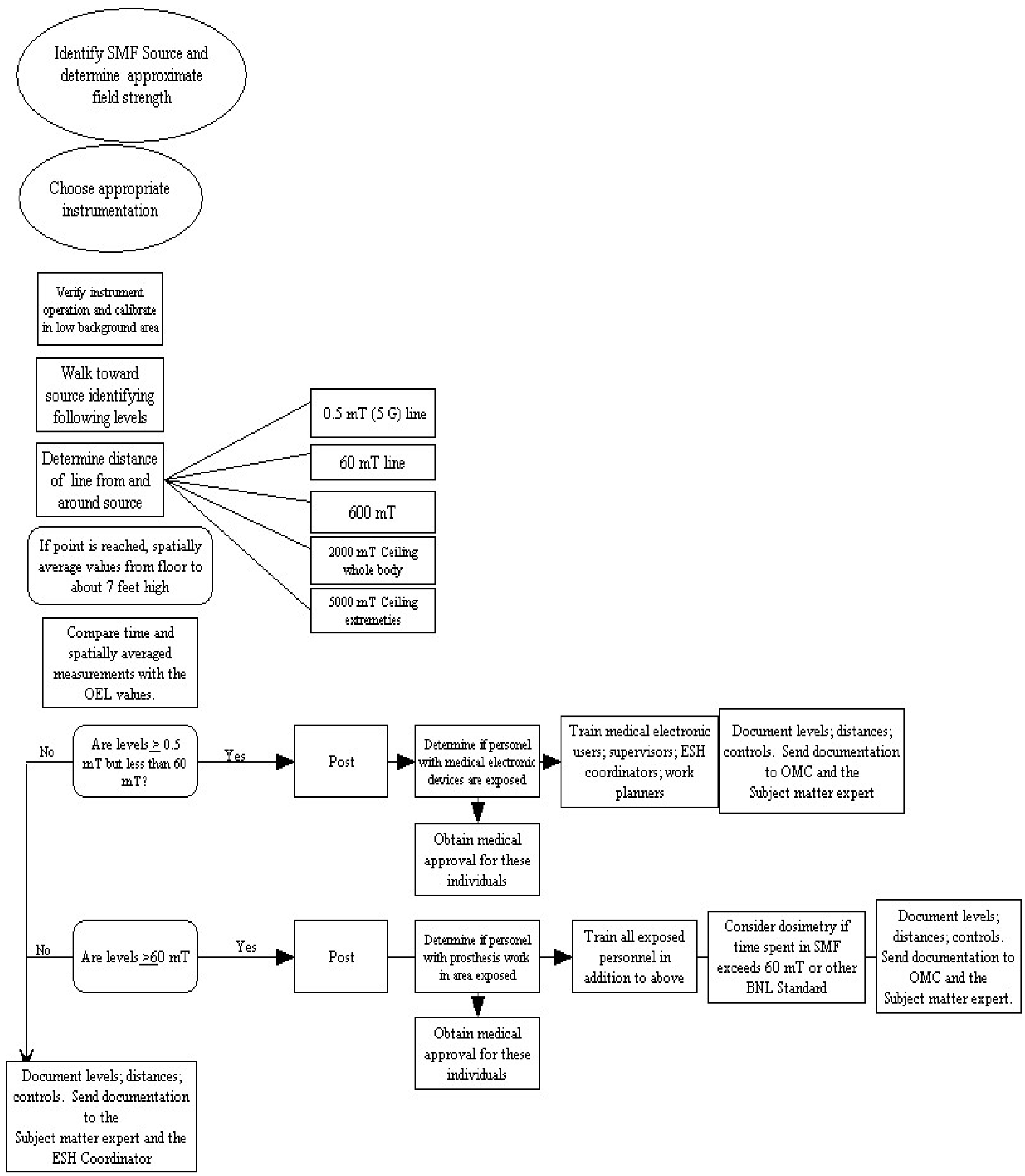
Attachment 9.1

Flowchart of Field Measurement Process



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Attachment 9.2
Theory of Magnetic Field Measurements

Magnetic fields are well defined in theory but do not behave predictably in real life. Often the root cause for the failure of a design involving magnetic fields is the designer's inability to understand how the lines of force, or flux lines, are generated or affected by the surrounding environment. Magnetic fields are perhaps more easily understood in terms of magnetic field lines. *Field lines*, also known as *lines of force*, define the direction and strength of the magnetic field at any local in space. Magnetic fields have both a direction and strength (or "magnitude"). The direction of the field lines indicates the direction of the field, while the *density* of the field lines indicates the magnitude of the field. Thus at points where the field lines are closer together, the field is stronger. Field lines are described mathematically with a quantity known as *flux*.

Magnetic fields are commonly a result of *magnetic dipoles*. A simple example of a magnetic dipole is the bar magnet.

The magnetic field lines always begin on the *north* pole of a magnet, and end on the *south* pole. Magnetic dipoles always like to align themselves parallel to an external magnetic field, so the dipole's field matches the one applied to it. This is why bar magnets line up north-to-south.

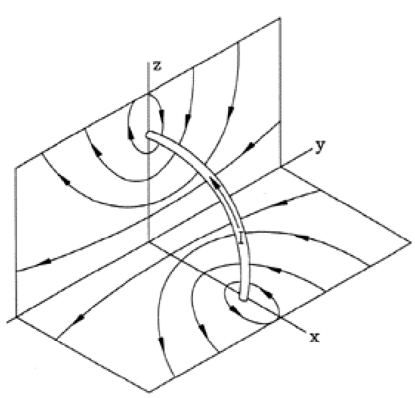
How strong is the magnetic field at a given distance from the magnet?

Elementary physics states that the magnetic field of a magnetic dipole is approximately proportional to the inverse <u>cube</u> of the distance from the dipole. Therefore, if you double the distance from the magnet, the magnetic field strength will be reduced (roughly) by a factor of 8.

The strength of a magnetic field is measured in units of *Gauss (G)*, or alternatively, in *Tesla (T)*. In the MKS (metric) system of units, 1 T = 1 kilogram*ampere/second^2 = 10^4 G.

For comparison, the magnetic field of the earth at the surface is on the order of 1 Gauss, where that of a Neodymium magnet is on the order of 10^4 Gauss. This means that Neodymium magnets produce magnetic fields *tens of thousands* of times stronger than those of the earth!

Technically, Gauss and Tesla are units of *magnetic induction*, also known as *magnetic flux density*. Quantitatively, the force on a charged particle q moving with velocity **v** is given by the vector equation **F** = q**v** x **B**, where **B** is the magnetic induction.



The magnetic field has vector components – x, y, and z. If the sensor uses a three-axis sensor – it will simultaneously read the fields three spatial components by aligning the three probes orthogonally. The THM meter is such a probe and does not require probe orientation. If the instrument does not do this (e.g., the Bell Gauss Meter), then the surveyor must take the vector components and take the root mean square average as follows:

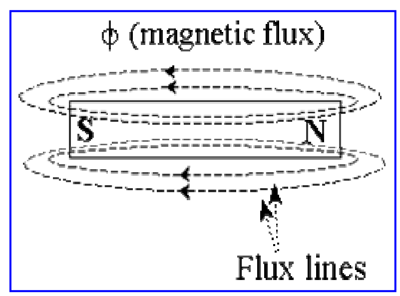
$$B = \sqrt{B_x^2 + B_y^2 + B_z^2}$$

or the user should peak the probe, a process in which the probe is rotated and tilted in several planes to obtain the highest possible output for a given field.

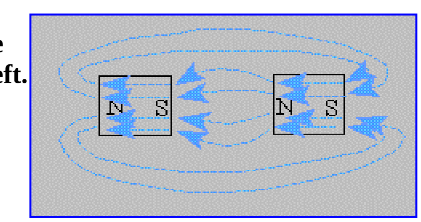
In physics, magnetic flux is the term used to describe the total amount of magnetic field in a given region. The term *flux* was chosen because the power of a magnet seems to "flow" out of the magnet at one pole and return at the other pole in a circulating pattern, as suggested by the patterns formed by iron filings sprinkled on a paper placed over a magnet or a conductor carrying an electric current. These patterns are called lines of induction. Although there is no actual physical flow, the lines of induction suggest the correct mathematical description of magnetism in terms of a field of force. The lines of induction originate on the north pole of the magnet and end on the south pole; their direction at any point is the direction of the magnetic field, and their density (the number of lines passing through a unit area) gives the strength of the field. Near the poles where the lines converge, the field and the force it produces are large; away from the poles where the lines diverge, the field and force are progressively weaker.

When we are referring to static magnetic fields, we are generally talking about the magnetic flux density (number of magnetic flux lines/area) rather than field strength. The number of flux lines per unit area is called flux density, it is denoted by B and is measured in webers/m^2 or teslas, T.

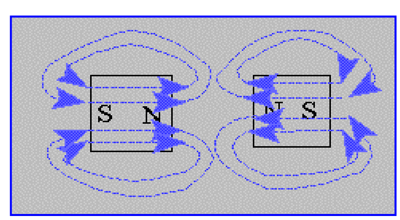
- **In electromagnetics, magnetic flux lines exist in continuous loops.**
- **Magnetic flux lines leave the north of a magnetic source, and return at the south.**



- **If unlike poles of two permanent magnets are brought together, the magnets will attract, and the flux distribution will be as shown at left.**



- **If like poles of two permanent magnets are brought together, the magnets will repel, and the flux distribution will be as shown at left.**



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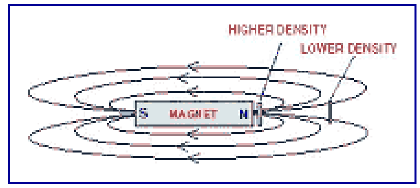


A Hall sensor is a four-terminal, solid-state device capable of producing an output voltage V H , proportional to the product of the input current, l c ,the magnetic flux density, B, and the sine of the angle between B and the plane of the Hall sensor. A reversal in the direction of either the magnetic field or the control current will result in a polarity change of V H . A reversal in the direction of both will keep the polarity the same. By holding the control current constant, the Hall voltage may be used to measure magnetic flux density. Multiplication may be accomplished by varying both the control current and the magnetic field..

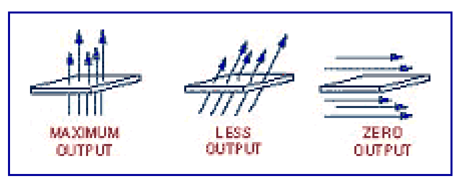
Sources of Error

Zeroing or nulling the Hall probe and meter is one of the most important steps toward obtaining accurate flux density measurements. Most Hall devices produce an offset signal in the absence of a magnetic field. Second, the internal circuitry of the meter itself is likely to produce a small offset signal even in the absence of an input signal. Finally, local flux from the Earth (~0.5 G) or nearby magnetic sources will affect the Hall sensor. The process of zeroing eliminates these errors.

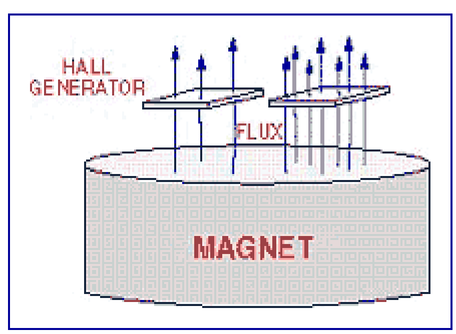
The probe is frequently placed in an assembly called a zero flux chamber to shield the device from all local flux. In other situations it may be desirable to zero the probe without the chamber so that all future readings are relative to the local flux condition.

Pay attention to the angle of the probe relative to the flux being measured. The highest output is generated when the flux lines are perpendicular to the Hall sensor. This is the way each Hall probe is calibrated and specified. It is often incorrectly assumed that the plane of the Hall generator is exactly the same as the axis of the probe's stem, but because of variations in material and manufacturing this alignment is not a certainty. The user should always peak the probe, a process in which the probe is rotated and tilted in several planes to obtain the highest possible output for a given field.

Figure: A hall generator output is related to the angle at which the flux lines pass through it. Maximum output is achieved when the lines are perpendicular to the sensor. At other angles the output follows a cosine function.



Measurement of permanent magnets can lead to confusing results: Flux density decreases as the distance from the pole face increases. The Hall generator will always be some finite distance from the pole face because there will always be material (the stem and air) between it and the magnet. Flux lines are seldom distributed evenly across the pole face of a magnet. Interior flaws such as cracks or bubble, or an inconsistent mix of materials, can result in flux density variations.



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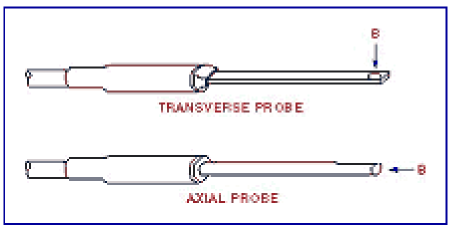
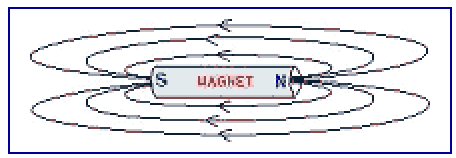
The Hall device will respond to this if it is much smaller than the than the face of the magnet.

Materials in the area
Finally, problems can arise from ferrous materials in the area where the test is being conducted. A steel workbench can redirect the flux lines from a magnet and cause erroneous results. Temperature effects, linearity errors, and reversibility errors should be taken into consideration. The user should always refer to the specifications and take advantage of additional performance data if the manufacturer offers them.





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Attachment 9.3

Static Magnetic Field Sampling forms

(see next 5 pages)

BROOKHAVEN NATIONAL LABORATORY

BNL Static Magnetic Fields Exposure Form

Part A: Source Hazard Assessment Record

USE THIS FORM TO DOCUMENT MAGNETIC FIELD SOURCES THAT ARE AT OR EXCEED 0.5mT (5 GAUSS)
Line Managers or Principal Investigators, and ES&H Coordinators complete a separate form for each Static Magnetic Field source. This assessment applies to occupational exposures only. This assessment does not apply to unmodified consumer products (phones, computer terminals, magnetic stirring devices, refrigerator magnets, etc.) that are used as intended.

I. Source Identification

Department:	Building:	Room or Area (location of source):

Identifier/ Name of Source:

Status of Source Usage (check all that apply):
[ ] In use on frequent basis [ ] Planned use in the near future [ ] Possible future use [ ] No planned use
[ ] Intermittent use [ ] One-time use [ ] Other:

Check or Describe Use or Process:
[ ] permanent magnet [ ] medical device [ ] Magnetic Resonance Imaging equipment [ ] Nuclear Magnetic Resonance equipment
[ ] super-conducting coils [ ] magnetometers [ ] accelerator magnets [ ] detector magnets [ ] ion pumps
[ ] electron microscope [ ] beam transport magnet [ ] electromagnet lifting device [ ] other (specify):

II. Exposure Summary [Complete Part B: Field Strength Measurement Record *or* attach documentation from manufacturer]

Target Body Area	BNL Exposure Limits (mT)	(G)
Cardiac Pacemaker (Ceiling)	0.5	5
Torso or Head (Whole Body) (8-hour TWA)	60	600
Ferromagnetic Objects (Ceiling)*	60	600
Extremities (Limbs) (8-hour TWA)	600	6,000
Extremities (Limbs) (Ceiling)	2,000 (2 T)	20,000
Whole Body (Ceiling)	5,000 (5 T)	50,000

*Ferromagnetic Objects (Ceiling), including medical implants and prostheses, may be affected by fields. Additional evaluation is required.

Maximum Exposure Potential surveyed applicable to worker exposure:

III. Exposure Hazard Evaluation [Check all that apply]

1. [ ] Field Strength does not exceed 0.5mT (5 Gauss). Go to section V.

2a. [ ] Field strength is at or exceeds 0.5 mT (5 Gauss). No potential for individuals with medical electronic devices to be exposed above exposure limits. Explain in line 4.

2b. [ ] Field strength is at or exceeds 0.5 mT (5 Gauss). Individuals with medical electronic devices* may be affected. List users of cardiac pacemakers and other medical electronic devices in Part C: Employee Exposure Record.

3a. [ ] Field strength is at or exceeds 60 mT (600 Gauss) but for less than 8 hours TWA. No individuals with medical electronic devices* or ferromagnetic implants/prostheses present.**

3b. [ ] Field strength is at or exceeds 60 mT (600 Gauss) but for less than 8 hours TWA. Individuals with medical electronic devices* or ferromagnetic implants/prostheses may be affected. List users of medical electronic devices or ferromagnetic implants/prostheses in Part C: Employee Exposure Record.**

3c. [ ] Field strength is at or exceeds BNL Exposure Limit (8-hr. TWA or ceiling limit). No potential for individuals to be exposed above BNL Exposure Limit. Explain in line 4.

3d. [ ] Field strength is at or exceeds BNL Exposure Limit (8-hr. TWA or ceiling limit). Potential for individuals to be exposed above BNL Exposure Limit. List the names of individuals in Part C: Employee Exposure Record.

BNL Static Magnetic Fields Exposure Form
Part A: Source Hazard Assessment Record

* Medical electronic devices includes cardiac pacemakers, electronic inner ear prostheses, insulin pumps. ** Ferromagnetic implants/ prostheses includes aneurysm clips, replacement hips.
4. Describe job/task and potential for employee exposures (e.g., type of work performed around source, method of control, time spent in fields [hours/day] and method of determining exposure):
5. Frequency of exposure (e.g., # days per year or month, # tests per year, in continuous use, etc.):

IV. Precautions / Engineering & Administrative Controls

Precautions During Use (check all that apply):	
___ Signs ___ Lights ___ Barriers ___ Restricted access ___ Rotation of workers ___ Working when de-energized ___ Use of nonferromagnetic tools ___ Physical indicator of fringe fields (e.g., use of string with paper clips or equivalent)	Other:

Written Documentation:
___ Experimental Review (ES&H Standard 1.3.5)
___ Work Planning and Control (ES&H Standard 1.3.6)
___ Written SOP (describe):

Other workers who may require information/written documentation/training to enter this area:

Checklist:
Employee training required: ____ Static Magnetic Fields Web Course ____ Dept/Division-Specific Training
Supervisors training required: ____ Static Magnetic Fields Web Course ____ Dept/Division-Specific Training
Training required to be linked in Job Training Analysis for affected work groups / job classifications: ____yes ____no

Medical approval required for individuals with medical electronic devices ____yes ____no
Medical review required for individuals above 8-hour TWA or ceiling ____yes ____no

V. Initial Assessment

Completed by:	**Date:**
Reviewed by ES&H Coordinator:	**Date:**

Forward the original form to the Static Magnetic Fields Subject Matter Expert, copies to your ES&H Coordinator and Facility Support Representative. Retain a copy in your files. Update and resubmit the assessment when changes occur.

BROOKHAVEN NATIONAL LABORATORY

BNL Static Magnetic Fields Exposure Form

Part B: Field Strength Measurement Record

Field Strength Measurement Record	
DATE:	**SURVEYOR:**

I. AREA INFORMATION		
DEPT.:	BLDG.:	ROOM:
SOURCE:		
CONTROLS: ___ BARRIERS ___ SIGNS ___ USE NON-FERROMAGNETIC TOOLS ___ OTHER:		

II. SURVEY INSTRUMENT INFORMATION		
INSTRUMENT:	MODEL:	SERIAL#:
FACTORY CALIBRATION DATE:	FUNCTIONAL CHECK (Test of meter response to known magnetic source) DATE:	

III. SAMPLING INFORMATION & RESULTS	
HAZARD: STATIC MAGNETIC FIELDS	UNITS: ___ mGauss ___ Gauss ___ mTesla ___ Tesla ___Amp/meter

INDICATE WHERE READINGS WERE TAKEN IN THE TABLE BELOW AND ON THE SKETCH (GRID) ON NEXT PAGE. EQUIVALENT METHODS OF DOCUMENTATION MAY BE ATTACHED (E.G., PICTURE, PLAN VIEW WITH EXPOSURE LEVELS INDICATED)

DISTANCE FROM SOURCE	LOCATION	READING	COMMENTS

BROOKHAVEN NATIONAL LABORATORY

BNL Static Magnetic Fields Exposure Form

Part B: Field Strength Measurement Record

Continuation of Section III.

INDICATE WHERE READINGS WERE TAKEN IN THE TABLE BELOW AND ON THE SKETCH (GRID) BELOW. EQUIVALENT METHODS OF DOCUMENTATION CAN BE ATTACHED (E.G., PICTURE,PLAN VIEW WITH EXPOSURE LEVEL INDICATED)

DISTANCE FROM SOURCE	LOCATION	READING	COMMENTS

Sketch of Survey Area. (Indicate positions on map where measurements were made.)

Forward the original form to the Static Magnetic Fields Subject Matter Expert, copies to your ES&H Coordinator and Facility Support Representative. Retain a copy in your files. Update and resubmit the assessment when changes occur.

BROOKHAVEN NATIONAL LABORATORY

BNL Static Magnetic Fields Exposure Form

Part C: Employee Exposure Record

Employee Exposure Record

DATE:	COMPLETED BY:

I. AREA INFORMATION

DEPT.:	BLDG.:	ROOM:
SOURCE:		

NOTE: MEASUREMENTS OR CALCULATIONS IDENTIFY THE INDIVIDIUALS BELOW TO HAVE THE POTENTIAL FOR EXCEEDING REGULATORY EXPOSURES LEVELS.

II. EMPLOYEE INFORMATION

FIRST NAME:	LAST NAME:	BNL #:
DEPT:	BLDG:	JOB TITLE:
EXPOSURE DURATION (Hrs):	EXPOSURE (Times per Day):	EXPOSURE (Days per Yr):
JOB/TASKS PERFORMED:		
Check all that apply: ___ MEDICAL ELECTRONIC DEVICE USER or ____ FERROMAGNETIC PROSTHESIS &		____ Exposure above BNL Exposure Limit ____ Exposure above 5 Gauss

FIRST NAME:	LAST NAME:	BNL #:
DEPT:	BLDG:	JOB TITLE:
EXPOSURE DURATION (Hrs):	EXPOSURE (Times per Day):	EXPOSURE (Days per Yr):
JOB/TASKS PERFORMED:		
Check all that apply: ___ MEDICAL ELECTRONIC DEVICE USER or ____ FERROMAGNETIC PROSTHESIS &		____ Exposure above BNL Exposure Limit ____ Exposure above 5 Gauss

FIRST NAME:	LAST NAME:	BNL #:
DEPT:	BLDG:	JOB TITLE:
EXPOSURE DURATION (Hrs):	EXPOSURE (Times per Day):	EXPOSURE (Days per Yr):
JOB/TASKS PERFORMED:		
Check all that apply: ___ MEDICAL ELECTRONIC DEVICE USER or ____ FERROMAGNETIC PROSTHESIS &		____ Exposure above BNL Exposure Limit ____ Exposure above 5 Gauss

Forward the original form to the Static Magnetic Fields Subject Matter Expert, copies to the Occupational Medicine Clinic, your ES&H Coordinator, and Facility Support Representative. Retain a copy in your files. Update and resubmit the assessment when changes occur.